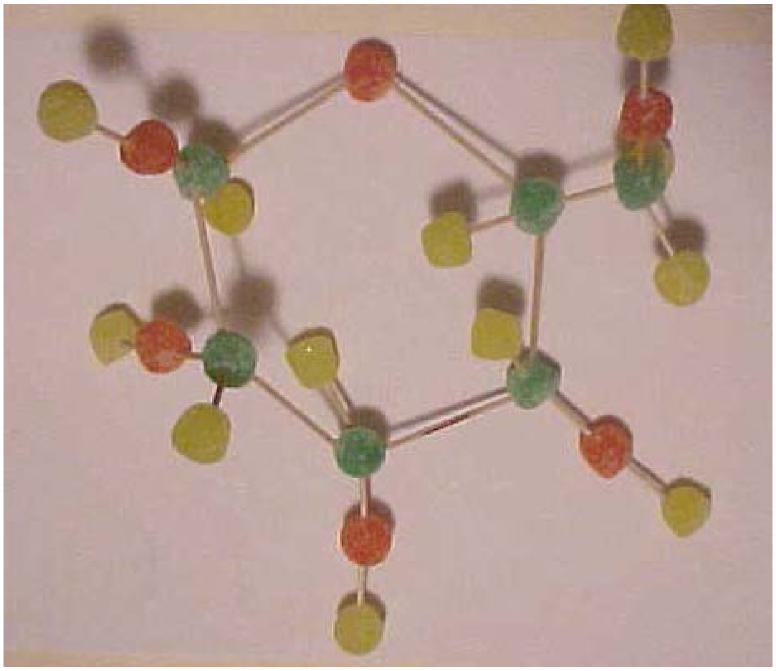
Teacher Background Information
Something Sweet (SC070101)

This lesson must be conducted carefully to set the tone for future lessons. It is vital that the teacher NOT make it into a chemistry lesson. To that end, keep these ideas in mind:

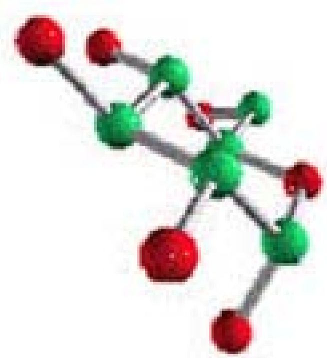
- Food motivates everyone. It is the main topic of this unit, so students should never have to ask, "Why are we learning this?" This unit is centered on food, not the chemistry of photosynthesis.
- Resist the impulse to talk about secondary benchmarks such as types of bonding, molecular structure, or decomposition (hydrolysis) reactions. The key ideas involved in **Something Sweet** are: (1) Sugar (glucose) is a food; (2) Sugar (glucose) is made of energetic atoms; (3) It takes energy to hold the atoms in their special shape (structure);(4) We eat to obtain the energy from food. Subsequent lessons explore how energy is put in and taken out of the sugar.
- The introductory exploration and discussion should generate two guiding questions, "What is food?" and "Why do we eat??" Discourage students from guessing answers to these questions. Instead, post the questions in the classroom and help students view themselves as scientists about to do many interesting investigations to discover answers.
- One analogy that has proved valuable is the "Jack-in-a-Box" or spring analogy. Putting the carbons together in an organic molecule is analogous to pushing the doll into a Jack-in-a-Box. We compress the spring and store energy into it. When the molecule is disassembled, it is like allowing the doll to come out of the box. The stored energy goes somewhere else. This visual has the potential of encouraging understanding at a "particle theory" level without requiring much understanding of bonding.

In the introductory experience, amylase, an enzyme in saliva, breaks the cracker's starch into sugar. Salted crackers don't work because the salt flavor masks the sugar and encourages excess saliva production. Some older books have students expectorate (spit) in test tubes, and then investigate the amount of starch in a cracker/water mixture before and after exposure to saliva. Due to concern about communicable diseases (chiefly Hepatitis B) this is not recommended.



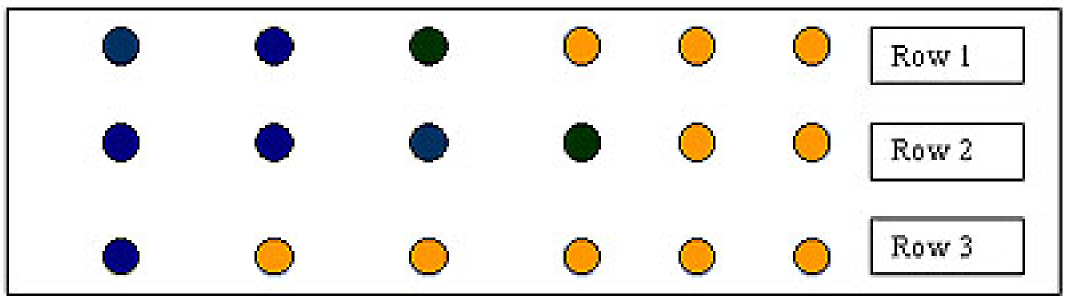
A student produced model of a sugar molecule.

A key idea for students to infer while making the model is that it takes effort/energy to hold wiggly (energetic) atoms in a structure like this. When students complain, “This is hard,” take the opportunity to challenge, “Imagine how much harder it would be if the gumdrops were vibrating like real molecules do!” *This is the point!* Try not to get more complex than this. In the questions, students are asked how the molecule is held together. The best answer would be “It takes energy.” The final section of the Student Pages asks students to think about all the ways food changes in their mouth.



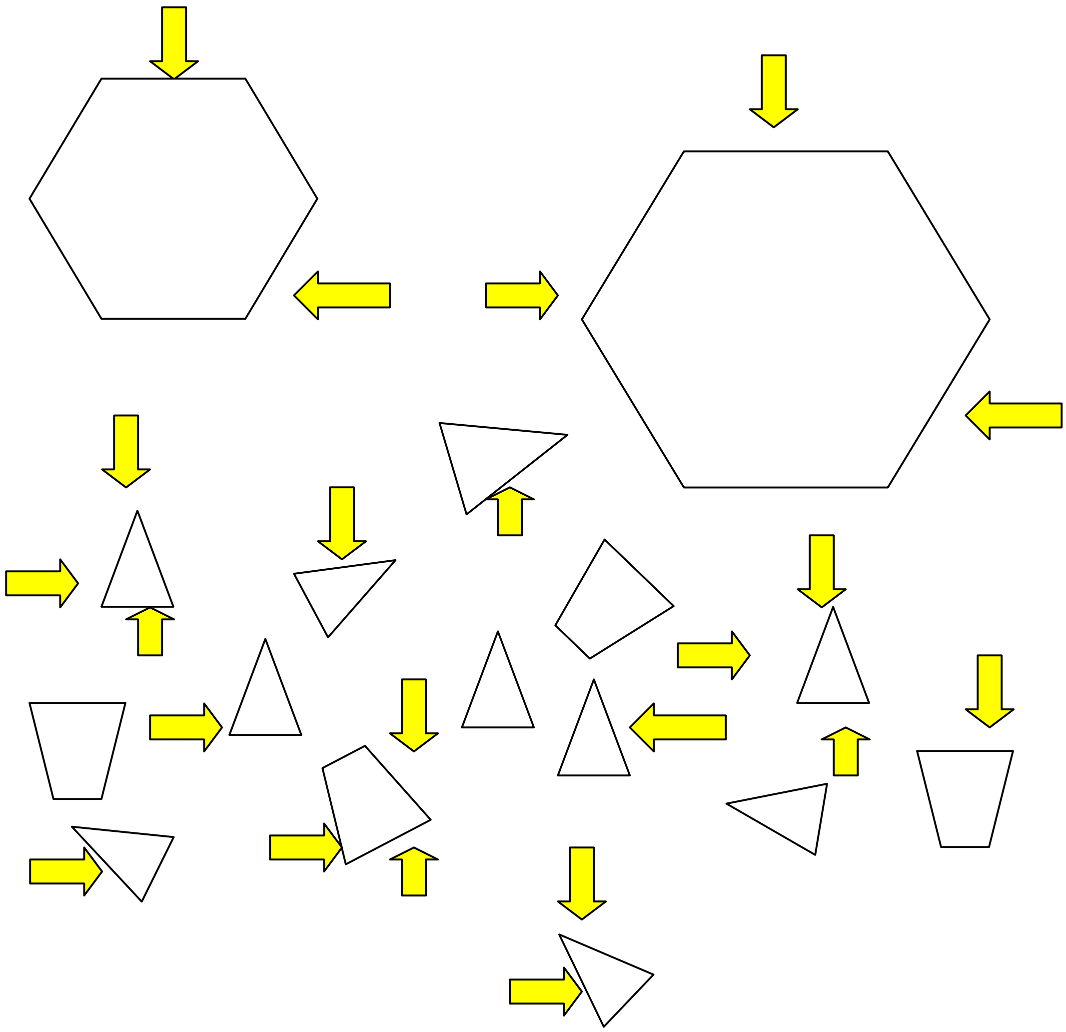
The glucose molecule (shown here) is one of several forms (isomers) of sugar. All share the same formula, $C_6H_{12}O_6$. Fructose (fruit sugar) has the same atoms in a slightly different shape. Sucrose (table sugar) is a larger molecule, formed from two glucose or fructose molecules. The chemical test for glucose is Benedict’s solution, which changes from blue to orange when heated with glucose. (**CAUTION: This reaction often bubbles and splashes out of a test tube**. **Eye protection required.)** Glucose test strips are commonly available in drug stores for use by diabetics. Students can use them to test for glucose, too.

Advanced extension:
If the resources are available, buy commercial amylase and conduct the following experiment: Mix a cracker or a little cornstarch with water. Test half of the solution with iodine. A blue-black color indicates the presence of starch. Then add about 3-5 ml of 1% amylase. After 10 minutes, test for iodine again. It should be gone. A more quantitative version of this experiment could be a science fair or independent research project. It leads to an understanding of why animals must keep their bodies warm: Make three mixtures of 5% starch (purchased from a supply company or made by dissolving starch in tepid water) and 20 ml water, one at room temperature (row 1), one with cold water (row 2) and one in water that feels warm to the touch (row 3). Put 1 ml of 2% amylase solution in each test tube, and quickly put a drop of solution in each of the wells of a test plate. Each minute, test one of the columns (one well from each sample) with iodine to see if the starch is still there. The diagram below shows that the starch was gone from the warm mixture in one minute, from the room temperature mixture in three minutes, and from the cold mixture in five minutes.



Blackline Master

Physical Digestion Is Chewing and Squeezing Food



Breaking Food Into Small Bits Makes It Easier for Digestive Enzymes to Work